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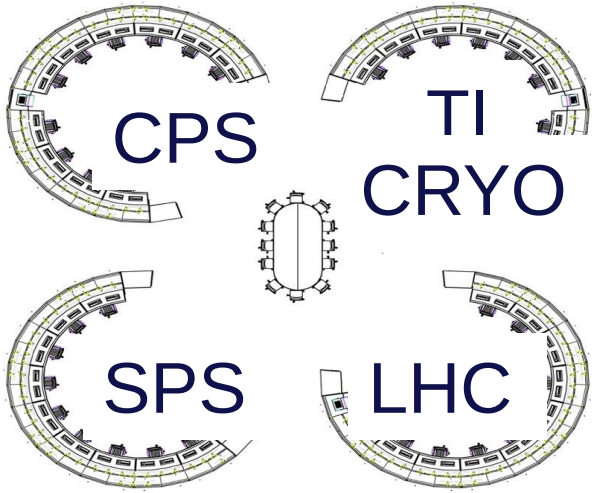
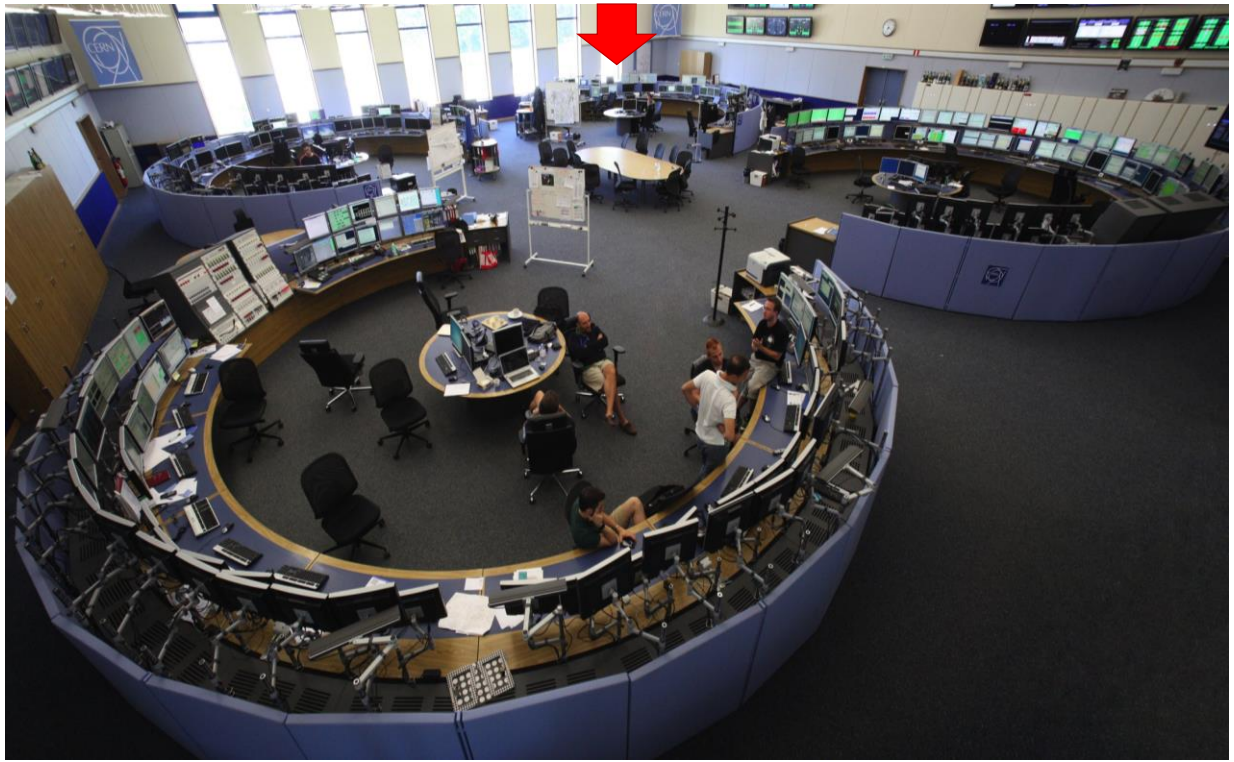
# CERN TECHNICAL INFRASTRUCTURE OPERATIONS

How we do business today and vision of the future !

# Technical Infrastructure operations at CERN today, how is it done?



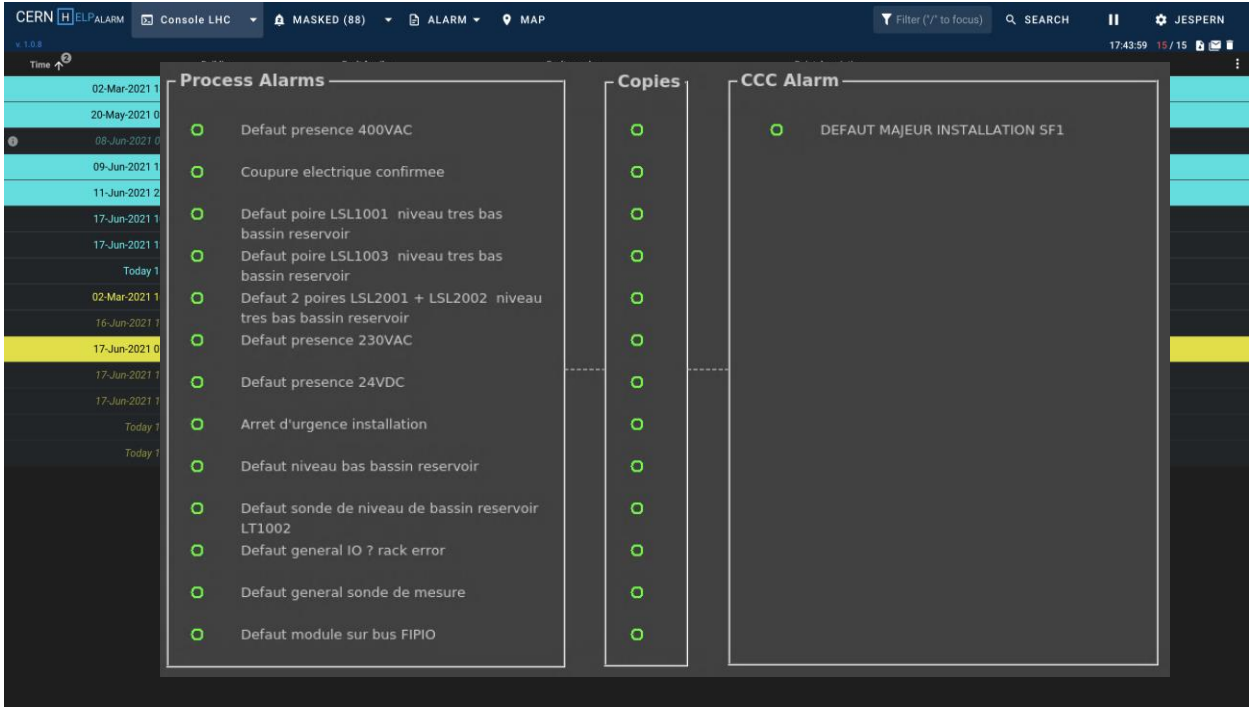



# Role of the TI operations

- Monitor alarms for all technical infrastructure at CERN
- Electricity, cooling, ventilation, safety, access, IT, etc.
- Coordinate major events between teams on the field and crisis teams
- Handle repair requests and maintenance
- On-site first-on-scene interventions when possible

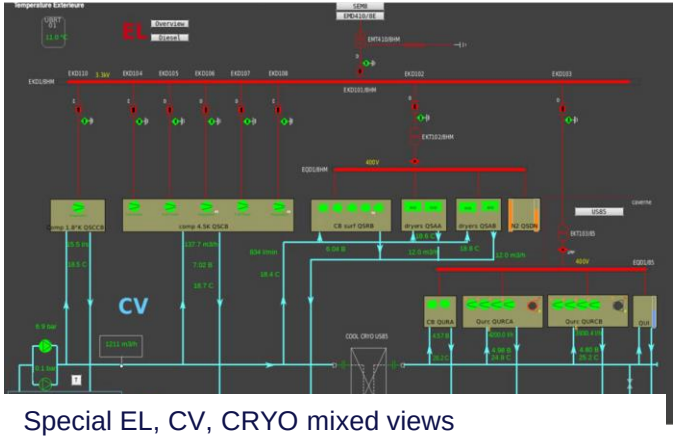
# Alarm screen: *Unique alarm screen for **almost** all alarms*

- Only “grouped” alarms
- Specialist views for detailed alarms only

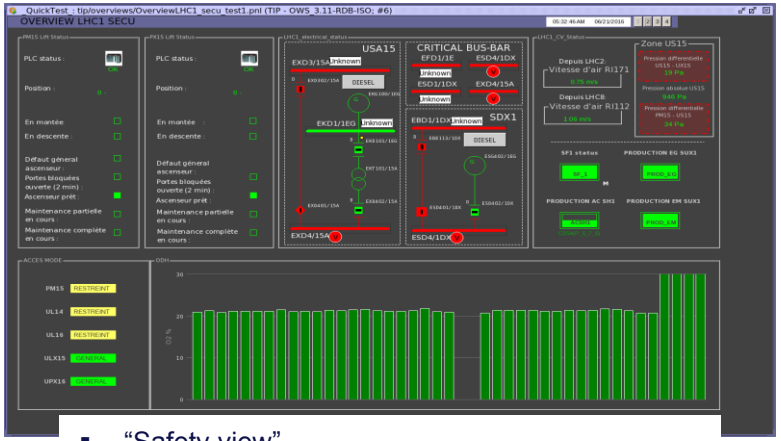


# Synoptics used today

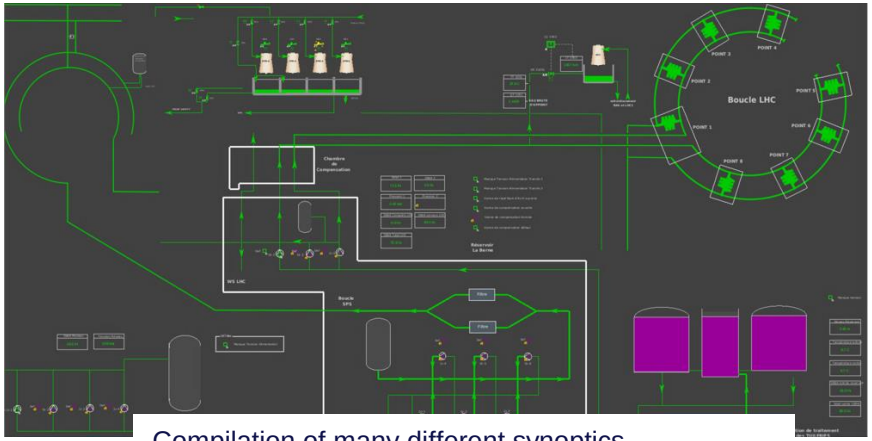
- Moving towards same system for synoptics for everything
- Started mixing data from different groups: **Very efficient approach!**
- **Collaboration** with EL, CV, EPC, ICS, CRYO, IT and others.




Special EL, CV, CRYO mixed views




- "Safety view"
- Mixed data for a LHC point
- (ODH, Safe Zone pressure, power, lifts, comms, etc.




Compilation of many different synoptics
In this case all CERN primary water

# Alarms and synoptics

- **Using grouped alarms to have less alarms in general, especially during breakdown**
- **Details available in specialist alarm screens**
- **Same tool for all alarms, less tools to know**
- **Same tool for synoptics across CERN: Huge gain in learning and adapting to a new system!**

# Points of action

Eyes on the field

- *Drones, robots, infrared*
- *Augmented reality*

Remote operations

- *Remote controls of installations*
- *Increased measurements*

Documentation, naming conventions

- *Much more details about each equipment*

Advanced tools

- *Dynamic fault detection*

# Eyes on

- Importance of s on locally
- Daily or weekly ld be done during calm times
- Adding infrared asurements would allow to detect oblems in installations.
- Automatic roun rning (it will easily compare value nd warn operator)

# Drones

- Usage of drones remotely from the control room to have a live feed from the field.
- Would give very valuable information whenever we have suspicion about things like water leaks, smoke detection, etc. that usually require an access and human intervention.
- Requests for adding cameras in service caverns show a real demand for this: https://edms.cern.ch/document/1808504/1

# Robots

- Alternatively to the drones we could imagine also robots, they would be slower but have the advantage of being able to stand still much longer and serve a live video feed without running out of battery too quickly.

- Could imagine robots having tools, controlled remotely too.

# Augmented Reality

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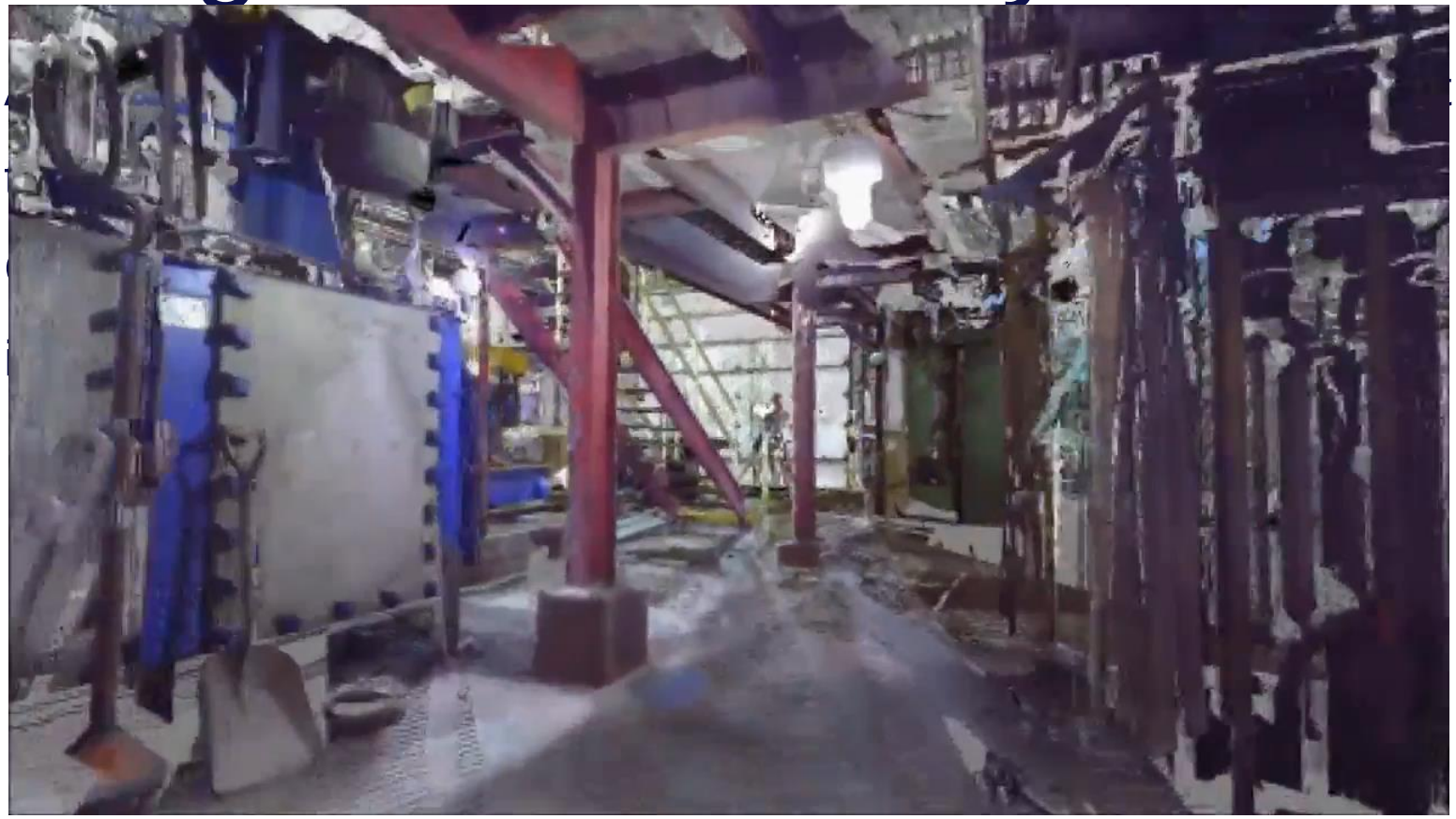
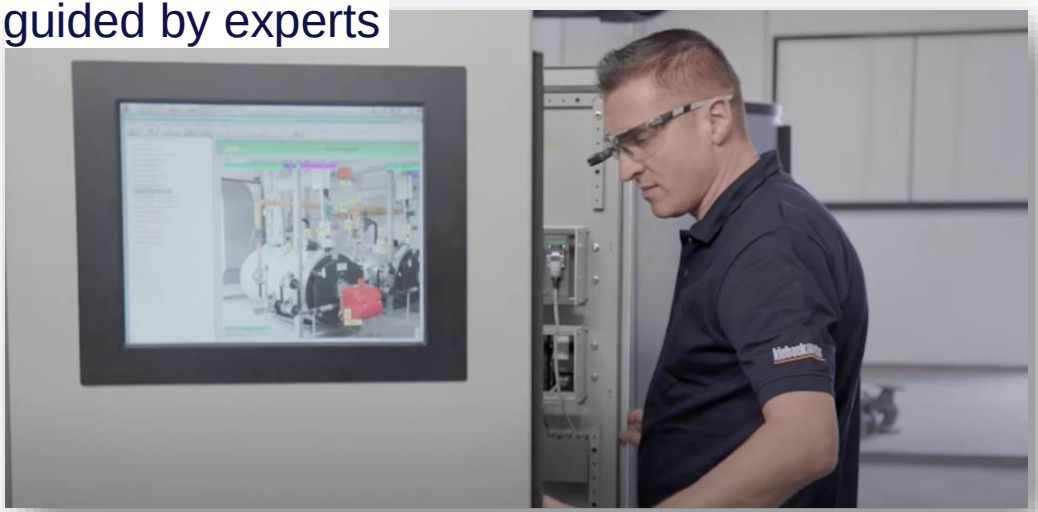


# Virtual glasses

- Sending live feed from what on-site technician sees to better guide him
- Specialist can guide first-on-scene interveners remotely
- Some companies use this already today
- Possible to work with local staff, guided by experts



# Remote operations

- Big value in operating remotely with a big machine.
- With good diagnostics and measurements it is inevitably easier to operate remotely too.

# More control remotely

*Controls of systems in the field are not always accessible for control room operators at CERN: Are some of the reasons historical or technical complexity?*

- Many different groups at CERN
- Hard to define responsibilities (who is allowed to do what?)
- Are operators well enough aware of the installations in question ?
- Sharing of specific information about installations could be improved?
- At CERN we prefer to switch on electrical installations locally, whilst it is actually possible to do it remotely
- Some things were true 50 years ago, not necessarily today

- Change of ”how we do” at CERN?
- Compare to other companies, lessons learned?

# Increased diagnostics

*Make it easier to intervene and diagnose remotely*

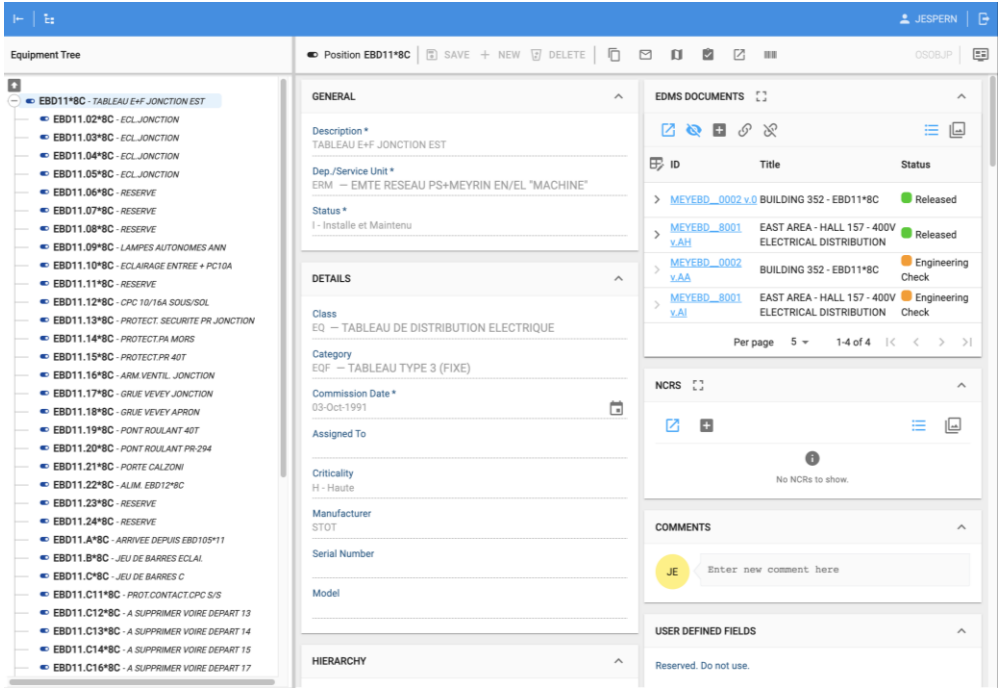
- Extensive usage of circuit breaker like the master pact series from Schneider that accept remote control and remote reset, also in low voltage?
- Increase measurements on electrical supplies.
- Dedicated electrical lines for groups of equipment, when you install new equipment group you install device to measure too.
- Compare cost vs benefit of monitoring more low voltage installations also?

# Documentation, naming conventions

- Should it be possible to install and power an equipment without properly documenting ?
- Would it be interesting to know from where an equipment is powered, how is it connected to IT, what it is powering, etc. ?
- Good value in easily having a map of information related to an equipment ?

# Powering equipment

- Powerful tools like INFOR EAM already exist at CERN
- Interesting to work towards more uniform way of exploiting and inserting this data ?
- **Often the limit is today not the tool but the data structure.**



# Examples of added value?

- Lots of information available in tools like GIS already
- Links between equipment ?
- Click an equipment and see relations?


*Pilot projects were done several times: Often problem with combabilities between databases, technologies were show stoppers*

# Advanced tools

- Grouping alarms together intelligently
- Hierarchy of alarms
- Logbooks entries based on fault detection
- Advanced tools can predict failures, using machine learning already today

# Common points

- It is not possible to predict the future
- Some of these techs are already there, others may appear!
- Really important thing is to plan for it at the design phase, **and be ready to adapt**

# Conclusion: Interesting times ahead!

Eyes on the field: *Confirm a fault remotely*

Remote operations: *Avoid travel time for simple operations*

Documentation, naming conventions: *Simplify collaborations, make tools work together easily*

Advanced tools: *Make intelligent use of all the data we have and will have available*